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LUMLEIAN LECTURES
ON THE
PNEUMOGASTRIC NERVE

HABERSHON

SECOND EDITION

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LUMLEIAN LECTURES

OF

THE ROYAL COLLEGE OF PHYSICIANS

1876

ON THE

PATHOLOGY

OF THE

PNEUMOGASTRIC NERVE,

BEING THE LUMLEIAN LECTURES
DELIVERED AT THE ROYAL COLLEGE OF PHYSICIANS
OF LONDON, 1876;

ALSO

COLD SHOCK IN ITS ACTION ON THE PNEUMOGASTRIC NERVE.

BY

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PREFACE TO SECOND EDITION.

THESE Lectures on the Pneumogastric Nerve have been so favorably received by the profession, that we venture to publish a second edition, as the former one has been for some little time out of print.

The symptoms of diseases of the throat, the lungs and the heart, as well as those of the stomach and liver, which are due to the connections of the pneumogastric nerve are so varied, that the full description of them would form a treatise on the maladies of the chest and abdomen, and we have therefore refrained from any enlargement of the previous Lectures; but we have appended a paper that was read before the Medical Society of London, on the effect of Cold Shock upon the branches of the Pneumogastric Nerve.

The effect of cold, in an exhausted system, is to produce a condition that may, with some correctness, be designated paralysis of the pneumogastric nerve; rapid congestion of the lung is induced, and the patient may die before the ordinary symptoms of inflammation are developed; or very severe bronchitis or pneumonia may supervene, and the patient's life is placed in imminent jeopardy. In another class of cases, the peripheral nerves supplied to the stomach and the liver are first attacked, *then* those of the lungs and heart; and the character of the disease is only correctly diagnosed when the connection of the pneumogastric nerve with the several structures is borne in mind. Some of these cases are regarded as fever, or as blood-poisoning, for the absence of the physical signs of disease are not attributed to their true cause. We hope that our observations will tend to elucidate these interesting and severe forms of disease.

70, Brook Street,
Grosvenor Square; 1885.

PREFACE TO FIRST EDITION.

HAVING received many expressions of interest in the Lectures which I had the honour of delivering before the President and Fellows of the Royal College of Physicians, I have ventured to present them to the profession in a collected form. I regret that I have not been able to expand the Lectures as I had desired. The subject is a complex one, and it is important, inasmuch as the pneumogastric nerve has relation to every vital function of the body; but although it is necessarily treated in an abbreviated form—for I have only traced some of its leading features—I trust the thoughts may prove suggestive and of practical value.

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PATHOLOGY
OF THE
PNEUMOGASTRIC NERVE.

LECTURE I.

ANATOMY AND PHYSIOLOGY—PATHOLOGY OF CERVICAL BRANCHES.

One of the most deeply interesting questions in physiological science is, in what manner the harmony of the different animal functions is maintained. The most delicately adjusted machinery is at work; actions of an entirely different character are performed without interfering the one with the other, and the result is recognised and expressed by the term of *health.* The body is a microcosm; and, as in the external world there is harmony in the working of natural forces, so in man's organism there is an adjustment of forces, an even balancing of the living power in its functional integrity, so that, with diversity of operation in the several parts, there is unity in the complex whole. The light of the sun exerts its silent but irresistible power on the vegetable life of the globe; and the plant, and flower, and tree grow and thrive as if Nature were alone for them. The chemical force in the plant is in operation, and the physical forces are ever in exercise; but the same light has equal power on animal organism; the heat and life go hand in hand, and move on undisturbed, and chemical and physical and living forces are found in correlative action: but not less powerful is the same influence of the sun upon the physical world, upon the waters of the ocean, in producing evaporation, in determining the currents of the sea, and in regulating the winds. There is wonderful harmony in the adjustment of these different spheres of operation, the vegetable kingdom with the animal, and these with the physical conditions by which the one and the other can exist and flourish.

The functions of animal life are equally diverse. Respiration is a function separate in itself, to ensure the admission and expulsion of air, for the purification and oxidation of the blood; it has its system of muscles and nerves, and adjustment of force. So also is that of the circulation of the blood, the central organ of which is the heart, a living, active, propulsive engine, by which the vital fluid is propelled both into the lungs and into the whole system. Equally distinct are those of deglutition and digestion, by which food is prepared and dissolved, and then absorbed into the circulatory system. Each of these functions—that of the respiration, that of the circulation, and that of digestion—acts independently, but still in unison. If one or other be disturbed, the whole system is thrown into disorder. Like the apparently complex mechanism of a locomotive engine, the disarrangement of one valve or of one connection will interfere with every part, and bring the power to a stand. In physiology, it is only a small part of the science to study *one* structure and *one* function; each must be taken in its connection with the whole; and so in pathological science. Few diseases can be regarded as strictly local in their character, and the morbid processes in one part are inseparably connected with those which take place in another. The union may be one of structure or of function; the connection may be by means of the supply of blood or the supply of nerves. If we would rightly know the diseases of one organ, we must be acquainted with those which have functional relationship with it. The pneumogastric nerve is a regulating medium, a bond of union between parts which are otherwise dissociated, separate in structure and in function, but united in the healthy working of the body. It holds in check structures which would individually act, but which without it would never harmonise.

I have ventured to submit some remarks on the "Pathology of the Pneumogastric Nerve," because there are some questions respecting it which have not received the attention which they deserve, and there are some clinical aspects of disease which are essentially connected with disturbance of the functional integrity of this nerve. In the animal economy, the pneumogastric nerve stands pre-eminent; the functions of the body with which it is connected are of the greatest importance for the maintenance of life, for it is connected with respiration, with circulation, and with digestion. These three most important functions are guided and controlled by this nerve, and to effect these purposes it is distributed to numerous structures, and its relations are of the most complex kind.

Before speaking of the pathology of the nerve, it will be well to review very briefly its anatomical distribution and its physiological action. The nerve appears at the base of the brain, at the side of the medulla oblongata, and at the front part of the restiform body, and behind the olivary. At this part it is in close proximity with the glosso-pharyngeal and with the spinal accessory nerves. The nerve passes through the medulla in the direction of the floor of the fourth ventricle, where several enlargements or nuclei are observed, which are connected with the nerves having origin at this part. The root of the pneumogastric is in the closest relation with the origin of the hypoglossal nerve—the nerve of the tongue; with the fifth nerve—the sensory nerve of the face, and of the orifices of the nose and mouth; with the seventh, that supplies the muscles of the face; with the glosso-pharyngeal, the nerve of the throat; and with the spinal accessory nerve, an important nerve of respiration. There is the most intimate connection between the nerves at this part, the fifth and seventh, the hypoglossal, the glosso-pharyngeal, spinal accessory, and pneumogastric nerves. "The fibres of origin of the vagus and glosso-pharyngeal nerves pass through the sensory portion of the fifth."* The beautiful sections made by Lockhart Clarke show the varied unions of the origin of these nerves. The latter author states,† that "the vesicular column that gives origin to the accessory nerve, after reaching the surface of the fourth ventricle as the nucleus of the vagus, sinks beneath the auditory ganglion, and, diminishing in size, becomes part of the nucleus of the glosso-pharyngeal nerve." It is here that the sensory or afferent impressions brought to the centre are reflected by the nerves of motion, which arise at the same part. As the fibres of the pneumogastric emerge from the brain, they pass to the jugular foramen (foramen lacerum basis cranii), where the nerve is surrounded by the same sheath of dura mater as the spinal accessory, and by the same layer of arachnoid membrane, but separated from the glosso-pharyngeal. In the foramen is a ganglionic enlargement : and there are connections, as described by Quain,‡ with the facial, with the spinal accessory, with the petrous ganglion of the glosso-pharyngeal, and with the sympathetic nerves. Half an inch lower down is a second ganglion of the pneumogastric, which is said not to include the branches of the spinal accessory sent to join the vagus; but the ganglion communicates not only with that nerve, but with the hypoglossal, the first two spinal, and with the upper ganglion of the sympathetic. The branches of the spinal accessory sent to join the pneumogastric, after leaving the foramen, may serve to explain the conflicting opinions of physiologists in reference to the motor fibres of the nerve. The spinal accessory nerve is in this way traced to the motor nerve of the larynx and to the palate, and is regarded as controlling the movements connected with vocalisation.

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* Carpenter's 'Physiology,' 7th ed., p. 558.

† 'Philos. Trans.,' pt. i, 1858.

‡ 'Anatomy,' 8th edition, vol. i, p. 559.

The first branch of the pneumogastric nerve is the *pharyngeal*, and it arises from the upper part of the trunk, and, uniting with branches from the glosso-pharyngeal, the superior laryngeal, and sympathetic, forms the pharyngeal plexus, from which branches are distributed to the muscles and to the mucous membrane of the pharynx.

The *superior laryngeal* is the sensory nerve of the larynx, and is divided into an external branch and an internal. The former branch is of great importance, inasmuch as deglutition and respiration require to be adjusted, otherwise food might more frequently pass into the larynx. It supplies the crico-thyroid muscle, the lower constrictor, and thyroid body, and sends a branch to the pharyngeal plexus. The explanation given by Mr Hilton in reference to this muscular supply is, that the larynx is prepared for the more delicate contractions due to the supply of branches from the recurrent nerve. The internal laryngeal supplies the mucous membrane of the larynx, the vocal cords, the epiglottis, and the base of the tongue; and it sends filaments to join the recurrent nerve.

The *recurrent* nerve is the motor nerve of the larynx, supplying its muscles, with the exception just mentioned; and it supplies branches to the trachea, the œsophagus, the mucous membrane of the pharynx, and also communicating filaments to the deep cardiac plexuses and to the superior laryngeal. It leaves the trunk of the nerve at the superior opening of the thorax, and then turns upward, passing round the subclavian artery on the right side, and the aorta on the left. The next branches of the pneumogastric are to the cardiac plexus, and then to the pulmonary; afterwards, upon the œsophagus we find the œsophageal plexus—plexus gulæ; thence it passes through the diaphragm into the abdomen. In the abdomen, numerous branches are distributed to the walls of the stomach.* The nerve joins the large sympathetic ganglion, the semilunar; branches may be traced to the liver, to the duodenum, to the ganglion on the vena cava, by which it is brought into connection with the phrenic. This connection of the pneumogastric and phrenic nerves is of great physiological and pathological interest.* The phrenic is distributed to the diaphragm, and afterwards it unites with both the pneumogastric and sympathetic nerve in a ganglion upon the vena cava. The diaphragm is the most important muscle of respiration; and is thus brought into harmonious action with the lungs by means of the pneumogastric. The same muscle has to do with the passage of food through the end of the œsophagus into the stomach—the closing act of deglutition. We find evidence of this connection in the spasmodic action of the diaphragm in hiccough, and we recognise it in the attempt to maintain the greatest quietness in the muscle during acute disease of the abdomen; so also in the intimate connection of disease immediately below the diaphragm with the pleura and the lung above it. In gall-stone and other diseases of that kind we often find pleuritic disease at the same time. Branches of the pneumogastric also may be traced to the pancreas, to the suprarenal capsule, and to the kidney, beside uniting with the sympathetic branches upon the aorta.

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* See preparation in the museum of Guy's Hospital.

Such is the extensive distribution of the pneumogastric nerve: and, before speaking of the pathology and the morbid conditions due to altered nerve-supply, we must very briefly refer to the physiology of the nerve. The nerve is of a double character, and contains both afferent and efferent fibres. It regulates the *respiratory* function. It is the minute afferent branches from the pulmonary plexus of this nerve that reach the structure of the lung and bronchi; and the impressions there received are transmitted to the brain, and are followed by reflex movements. By its connection with the fifth and seventh nerves, the entrance of air by the mouth is regulated; by means of the hypoglossal the tongue is adjusted so as not to interfere with the free passage of air; the glosso-pharyngeal and external branch of the superior laryngeal bring the pharynx into right sympathetic action; the internal branches and the recurrent regulate the glottis; and the muscles of respiration supplied by the spinal accessory, the phrenic, and branches of the spinal nerves, complete the respiratory act. The important nerve-centre of this function is at the origin of the pneumogastric at the floor of the fourth ventricle. It is the minute branches of this nerve which, distributed to the bronchial tubes, produce constriction and narrowing of the tubes, so painfully manifested in spasmodic asthma. According to Rosenthal, the superior laryngeal nerve has inhibitory action upon the movements of respiration and upon the diaphragm, and acts centripetally on the brain; and Burkart has shown that the inferior or recurrent nerve exerts similar power.

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* See dissection of mine and preparation in the museum of Guy's Hospital.

Another important function which is controlled by the pneumogastric is the process of *deglutition*; the